Depth-dependent composition of sputtered ZnO:Al

Crovetto, Andrea; Ottsen, Tobias; Stamate, Eugen; Kjær, Daniel; Schou, Jørgen; Hansen, Ole

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

DTU Nanotech
Department of Micro- and Nanotechnology

DTU Fotonik
Department of Photonics Engineering

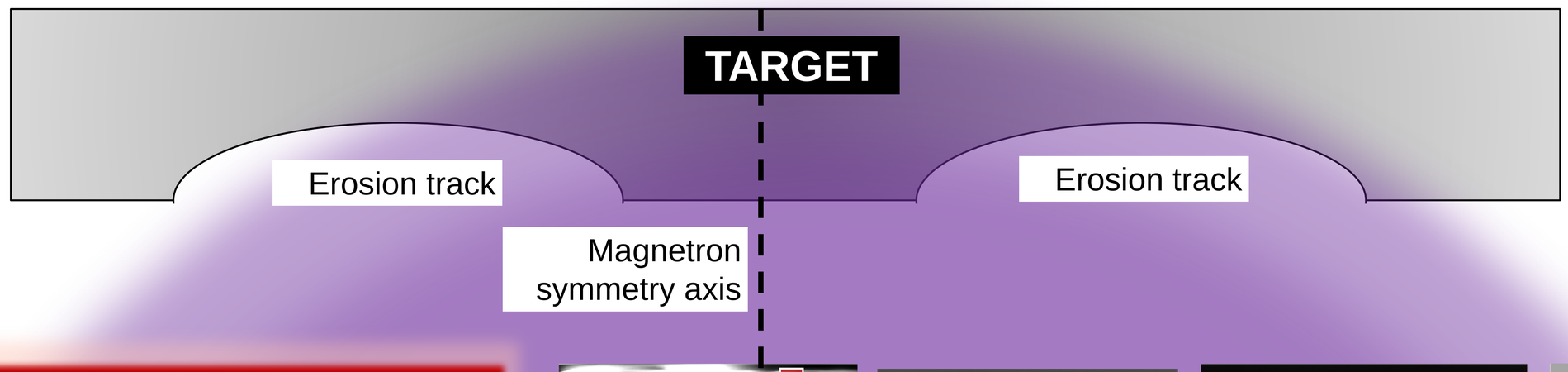
CAPRES A/S
COPENHAGEN APPLIED RESEARCH

DTU Energy
Department of Energy Conversion and Storage

Depth-dependent composition of sputtered ZnO:Al

Andrea Crovetto[(1)], Tobias Ottsen[(1)], Eugen Stamate[(2)], Daniel Kjær[(1,3)], Jørgen Schou[(4)] and Ole Hansen[(1)]

[(1)] DTU Nanotech, Technical University of Denmark; [(2)] DTU Energy, Technical University of Denmark
[(3)] CAPRES A/S, Kgs. Lyngby, Denmark; [(4)] DTU Fotonik, Technical University of Denmark



The film

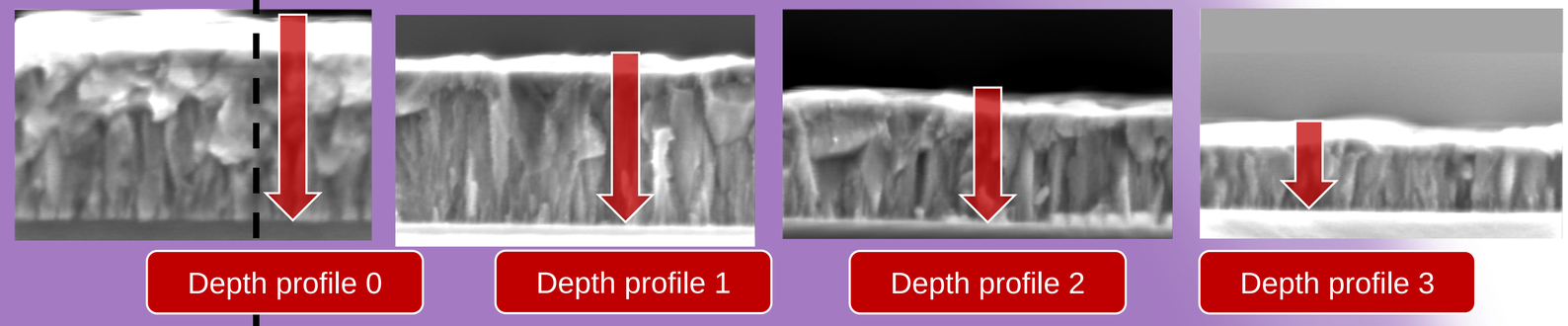
- ZnO with 2% Al from ceramic target
- RF sputtering at 150°C on **Si substrate**
- **Low pressure** regime (2.5 mTorr – 5 mTorr) where ion bombardment has a strong spatial dependence

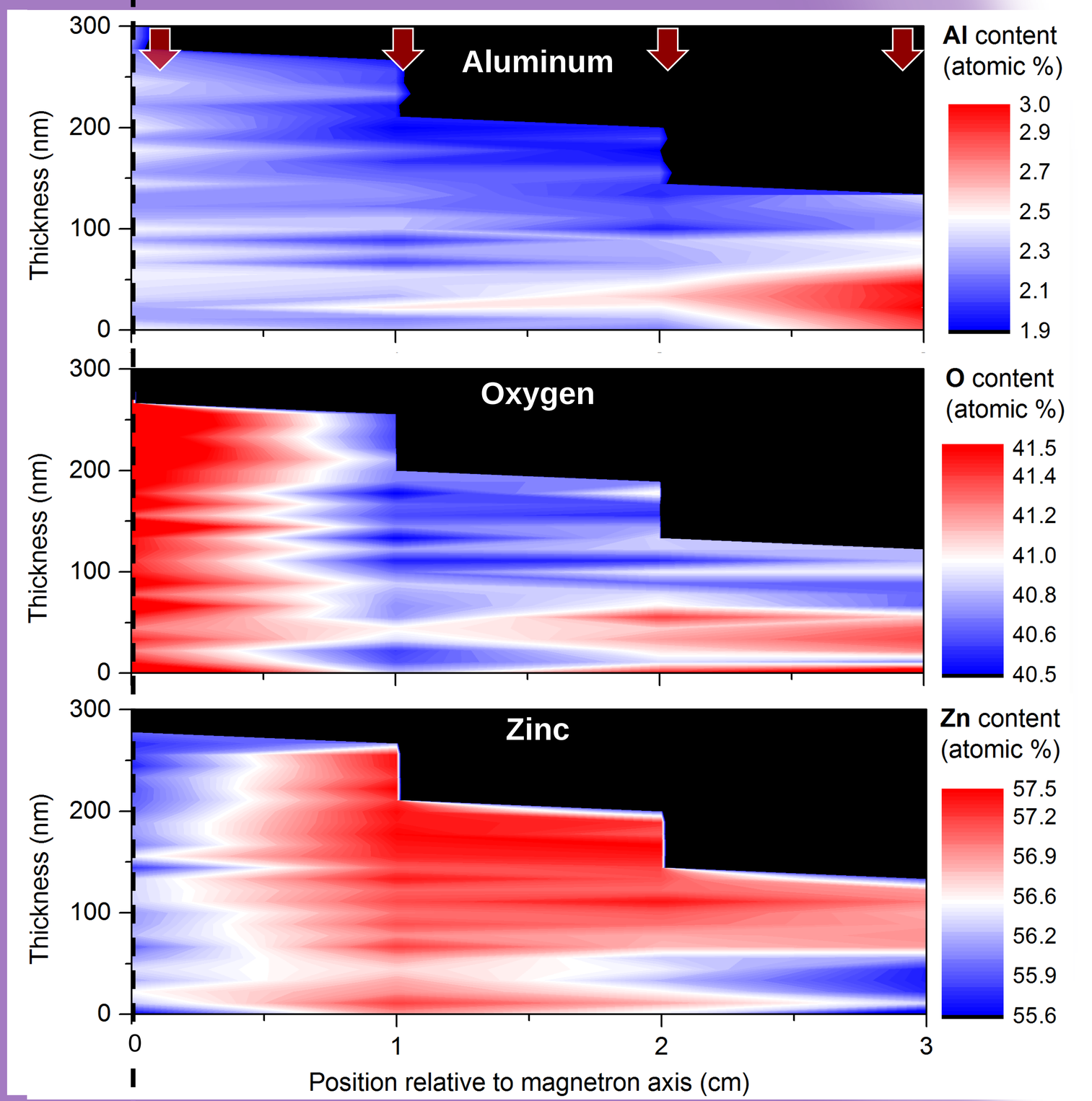
The analysis technique

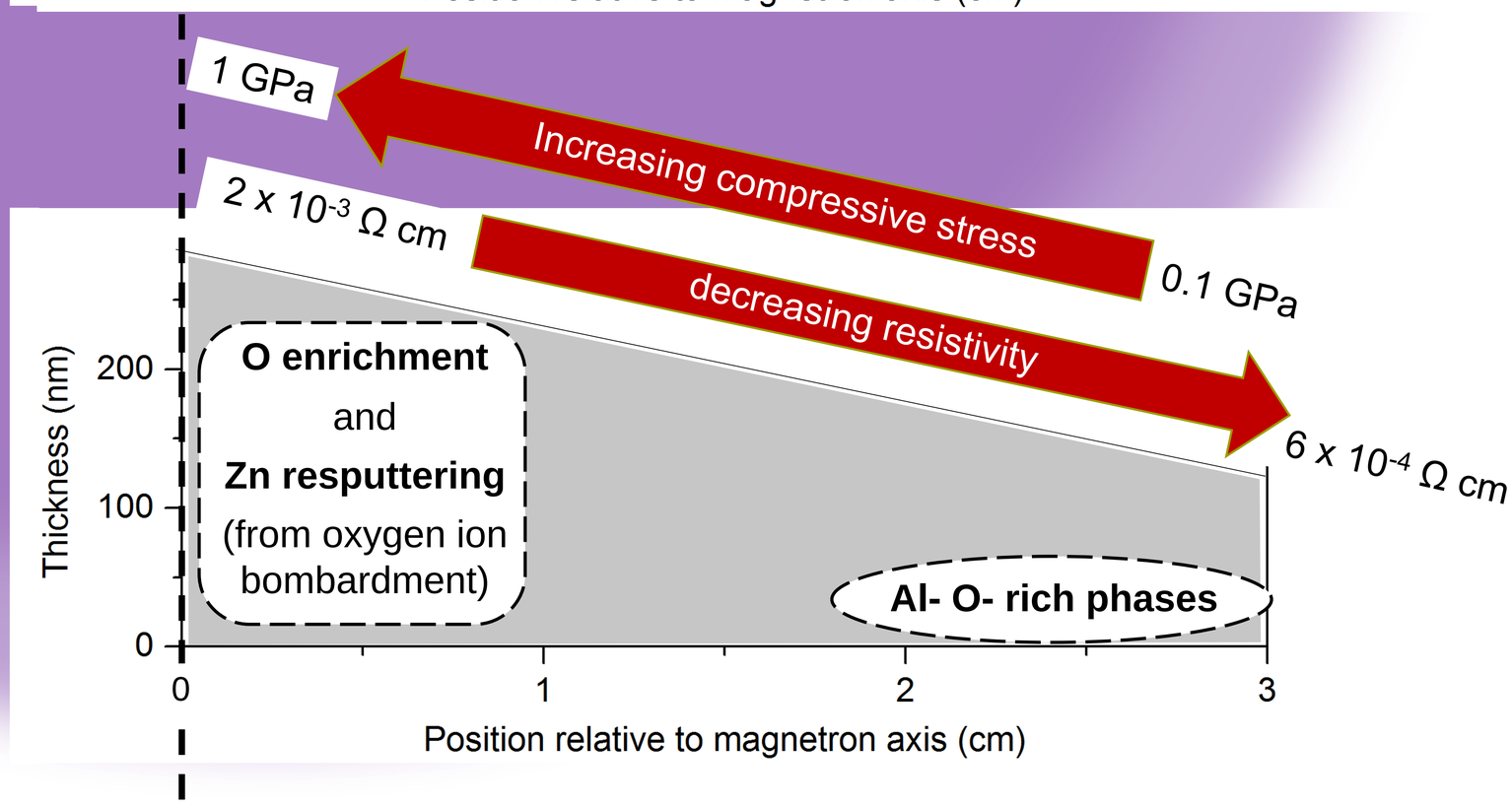
- X-ray photoemission spectroscopy (**XPS**)
- Depth profile by ion beam sputtering at 500 eV and elemental quantification

Conclusion

- **Al- O- rich phases** at back interface are observed at positions far away from the magnetron axis
- **Al- O- rich phases** occur for deposition pressures up to 5 mTorr, in the positions with state-of-the-art resistivity **[1]**
- Avoiding **Al- O- rich phases** may further decrease record resistivity **[2]**







[1] A. Crovetto et al., Performance limitations and property correlations of Al-doped ZnO deposited by RF sputtering, *J. Phys. D: Appl. Phys* **49** (2016) 295101

[2] A. Bikowski, K. Ellmer, Inhomogeneous aluminium dopant distribution in magnetron sputtered ZnO:Al thin films and its influence on their electrical properties, APL Mater. **3** (2015) 060701

Acknowledgments

This work has been supported by a grant from the Danish Council for Strategic Research.

ancro@nanotech.dtu.dk